§ 1066.240 Torque transducer verification and calibration.

Calibrate torque-measurement systems as described in 40 CFR 1065.310.

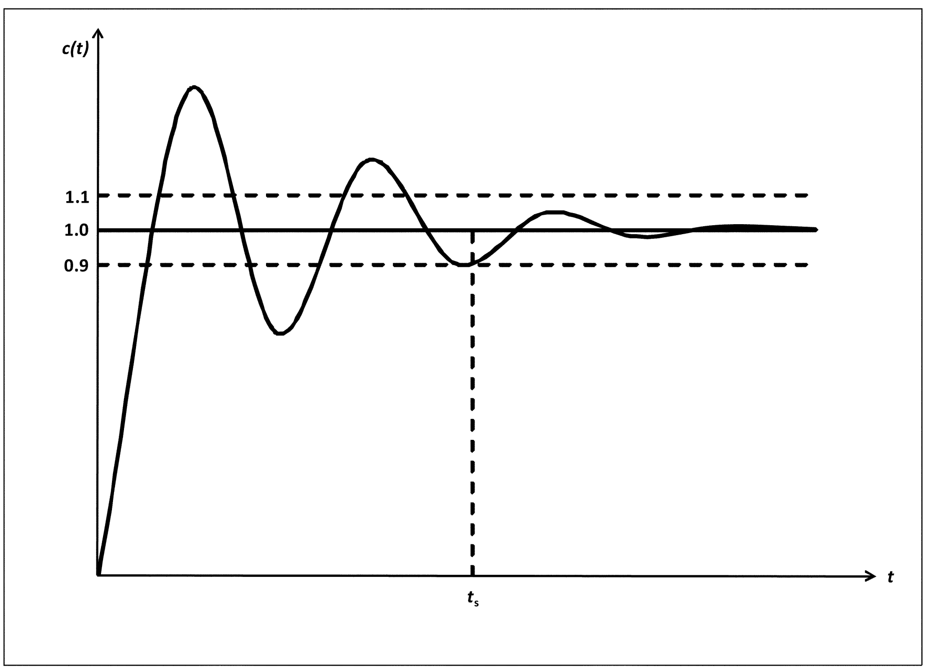
§ 1066.245 Response time verification.

(a) *Overview*. This section describes how to verify the dynamometer's response time.

(b) *Scope and frequency*. Perform this verification upon initial installation and after major maintenance.

(c) *Procedure*. Use the dynamometer's automated process to verify response time. Perform this test at two different inertia settings corresponding approximately to the minimum and maximum vehicle weights you expect to test. Use good engineering judgment to select road-load coefficients representing vehicles of the appropriate weight. Determine the dynamometer's settling response time, t_s, based on the point at which there are no measured results more than 10% above or below the final equilibrium value, as illustrated in Figure 1 of this section. The observed settling response time must be less than 100 milliseconds for each inertia setting.

Figure 1 of §1066.245—Example of a settling response time diagram.



§ 1066.250 Base inertia verification.

(a) *Overview*. This section describes how to verify the dynamometer's base inertia.

(b) *Scope and frequency*. Perform this verification upon initial installation and after major maintenance.

(c) *Procedure*. Verify the base inertia using the following procedure:

(1) Warm up the dynamometer according to the dynamometer manufacturer's instructions. Set the dynamometer's road-load inertia to zero and motor the rolls to 5 mph. Apply a constant force to accelerate the roll at a nominal rate of 1 mph/s. Measure the elapsed time to accelerate

from 10 to 40 mph, noting the corresponding speed and time points to the nearest 0.01 mph and 0.01 s. Also determine average force over the measurement interval.

(2) Starting from a steady roll speed of 45 mph, apply a constant force to the roll to decelerate the roll at a nominal rate of 1 mph/s. Measure the elapsed time to decelerate from 40 to 10 mph, noting the corresponding speed and time points to the nearest 0.01 mph and 0.01 s. Also determine average force over the measurement interval.

(3) Repeat the steps in paragraphs (c)(1) and (2) of this section for a total of five sets of results at the nominal acceleration rate and the nominal deceleration rate.

(4) Use good engineering judgment to select two additional acceleration and deceleration rates that cover the middle and upper rates expected during testing. Repeat the steps in paragraphs (c)(1) through (3) of this section at each of these additional acceleration and deceleration rates.

(5) Determine the base inertia, I_b, for each measurement interval using the following equation:

$$I_{\mathrm{b}} = \frac{F}{\left|\frac{S_{\mathrm{final}} - S_{\mathrm{initial}}}{\Delta t}\right|}$$

Eq. 1066.250-1

Where:

F = average dynamometer force over the measurement interval as measured by the dynamometer, in ft·lbm/s^2.

S_{final} = roll surface speed at the end of the measurement interval to the nearest 0.01 mph.

S_{initial} = roll surface speed at the start of the measurement interval to the nearest 0.01 mph.

Δt = elapsed time during the measurement interval to the nearest 0.01 s.

Example:

F = 1.500 lbf = 48.26 ft·lbm/s^2

S_{final} = 40.00 mph = 58.67 ft/s

S_{initial} = 10.00 mph = 14.67 ft/s

Δt = 30.00 s

$$I_{\mathrm{b}} = \frac{48.26}{\left|\frac{58.67 - 14.67}{30.00}\right|}$$

I_b = 32.90 lbm

(6) Determine the arithmetic mean value of base inertia from the five measurements at each acceleration and deceleration rate. Calculate these six mean values as described in 40 CFR 1065.602(b).

(7) Calculate the base inertia error, I_{berror}, for each measured base inertia, I_b, by comparing it to the manufacturer's stated base inertia, I_{bref}, using the following equation:

$$I_{\text{berror}} = \frac{I_{\text{bref}} - I_{\text{bact}}}{I_{\text{bref}}} \cdot 100\ \%$$

Eq. 1066.250-2

Example:

I_{bref} = 32.96 lbm

$\bar{I}_{\text{bact}}$ = 33.01 lbm

$$I_{\text{berror}} = \frac{32.96 - 33.01}{32.96} \cdot 100\ \%$$

I_{berror} = −0.15%

(8) Calculate the inertia error for each mean value of base inertia from paragraph (c)(6) of this section. Use Equation 1066.265–2, substituting the mean base inertias associated with each acceleration and deceleration rate for the individual base inertias.

(d) *Performance evaluation.* The dynamometer must meet the following specifications to be used for testing under this part:

(1) The base inertia error determined under paragraph (c)(7) of this section may not exceed ±0.50% relative to any individual value.

(2) The base inertia error determined under paragraph (c)(8) of this section may not exceed ±0.20% relative to any mean value.

§ 1066.255 Parasitic loss verification.

(a) *Overview.* Verify and correct the dynamometer's parasitic loss. This procedure determines the dynamometer's internal losses that it must overcome to simulate road load. These losses are characterized in a parasitic loss curve that the dynamometer uses to apply compensating forces to maintain the desired road-load force at the roll surface.

(b) *Scope and frequency.* Perform this verification upon initial installation, within 7 days of testing, and after major maintenance.

(c) *Procedure.* Perform this verification by following the dynamometer manufacturer's specifications to establish a parasitic loss curve, taking data at fixed speed intervals to cover the range of vehicle speeds that will occur during testing. You may zero the load cell at the selected speed if that improves your ability to determine the parasitic loss. Parasitic loss forces may never be negative. Note that the torque transducers must be zeroed and spanned prior to performing this procedure.

(d) *Performance evaluation.* In some cases, the dynamometer automatically updates the parasitic loss curve for further testing. If this is not the case, compare the new parasitic loss curve to the original parasitic loss curve from the dynamometer manufacturer or the most recent parasitic loss curve you programmed into the dynamometer. You may reprogram the dynamometer to accept the new curve in all cases, and you must reprogram the dynamometer if any point on the new curve departs from the earlier curve by more than ±4.5 N (±1.0 lbf).

§ 1066.260 Parasitic friction compensation evaluation.

(a) *Overview.* This section describes how to verify the accuracy of the dynamometer's friction compensation.

(b) *Scope and frequency.* Perform this verification upon initial installation, within 7 days before testing, and after major maintenance. Note that this procedure relies on proper verification or calibration of speed and torque, as described in §§ 1066.235 and1066.240. You must also first verify the